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withdrawn from consideration.

Notwithstanding, Applicants have canceled, without prejudice, Claim 12 and have amended Claims 1 to include the limitations of Claim 12. Basis for the amendment can be found throughout the specification and originally-filed claims, specifically page 7, lines 5-20. Claim 16 has also been amended to independent form.

Reconsideration is respectfully requested in light of the present amendments and following remarks. The above amendments and following remarks are believed to be fully responsive to the outstanding Office Action and render all claims at issue patentably distinct over the references cited.

### **35 U.S.C. §102**

The Examiner has rejected Claims 1-6, 8, 9, 14, and 15 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,527,628 (the '628 patent) to Anderson et al. Applicants respectfully traverse this rejection and request reconsideration. It is believed that all of the originally filed claims are patentably distinct over the cited reference.

In order for the '628 patent to anticipate the claims of the present invention, the patent must disclose every element set forth in the claims. Applicants submit that the present invention is not anticipated by the '628 patent because the patent fails to disclose several elements of the claims of the present invention. First, the '628 patent does not disclose or teach a method to produce a composite solder. A composite solder is well known in the art to be a solder alloy to which intermetallic particles have been added. Instead, the '628 patent

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discloses a ternary eutectic solder that is produced by melting the elemental components of Ag, Cu and Sn together. Col. 2, lines 41-45 and col. 4, lines 15-27. Upon remelt and subsequent cooling, intermetallic compounds consisting of the elemental components were observed. Col. 5, line 59 to col. 6, line 15. Unlike a composite material, in which the intermetallic particles do not dissolve or merge into the solder alloy, the intermetallic compounds observed in the ternary eutectic solder disappear upon remelt of the solder.

In contrast, the methods of the present invention produce a composite solder to which a discrete intermetallic phase is added to an existing solder. Furthermore, the intermetallic phase need not comprise the same elements of the solder. By way of a preferred example, but not being limited thereto, the ternary eutectic solder of the '628 patent can be mixed with the components of the intermetallic phase,  $\text{Ni}_3\text{Sn}_4$  to produce a composite solder of the present invention.

Second, the '628 patent does not disclose, teach or suggest a method for producing any solder alloy, none the less a composite solder, in which the elemental components are melted together and rapidly cooled at a rate of 100 °C/sec, nor that it would be advantageous to do so. The ternary eutectic solder is produced in the conventional way by melting the elemental components and then solidifying by quenching in a water bath. Col. 4, lines 23-27. In contrast, the methods of the present invention produce a composite solder by mixing the solder with the components of the intermetallic phase, heating the mixture to a temperature high enough to melt all the components, and then rapidly cooling the mixture at a rate of at least 100 °C/sec.

Finally, although the '628 patent does disclose using chill casting and spray

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atomization, it does not disclose their use in preparation of the ternary eutectic solder itself, but for converting the solder into different physical forms such as ingots, sheets and powders. Col. 5, line 59 to col. 6, line 15. The solder is remelted at a temperature just above the eutectic melting point and then formed into ingots, sheets or powders. The '628 patent does not disclose the addition of an intermetallic phase before doing so, nor does it suggest that it would be advantageous. In contrast, the methods of the present invention require these methods for rapidly cooling the composite solder as it is formed, not during a remelt. Moreover, the mixture of solder and the components of the intermetallic phase is heated to a temperature greater than the highest melting temperature of any of the individual components of the intermetallic phase. This is significantly higher than the eutectic melting temperature of a solder alone. In an effort to expedite prosecution of this case, but while vigorously traversing the Examiner's rejection, Applicant's have amended Claim 1 to add this limitation.

Applicants thus submit that the '628 patent does not disclose, teach or suggest the method of the present invention for producing an *in situ* composite solder. Specifically, the '628 does not disclose, teach or suggest methods for producing a composite solder, nor suggest that a superior product will result with rapid cooling during production of the solder itself. Applicants therefore request withdrawal of the rejection.

### 35 U.S.C. §103

The Examiner has rejected Claims 1-6, 8, 9, 14 and 15 under 35 U.S.C. §103(b) as being unpatentable over the '628 patent. Applicants respectfully traverse this rejection and request reconsideration. It is believed that all of the originally filed claims are patentably distinct over the cited reference.

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Applicants submit that the methods of the present invention to produce a composite solder are novel and that the '628 patent does not teach, suggest or motivate these methods for the reasons discussed above. Specifically, the '628 patent does not teach how to make composite solders in which a discrete intermetallic phase is added to a solder alloy. As described above, the '628 patent describes a specific ternary eutectic solder. Moreover, the '628 patent does not teach rapidly cooling the melted elemental components to form the solder. It also does not suggest that it would be advantageous or that a superior product would be obtained if such rapid cooling were used. The Examiner is improperly using hindsight reasoning in combination with this reference given the present invention as a template. Notwithstanding, this rejection is moot in light of the amendment to independent Claim 1. Applicants thus submit that the '628 patent does not disclose, teach or suggest the methods of the present invention for producing a composite solder with superior properties and therefore request withdrawal of the rejection.

The Examiner has also rejected Claim 7 under 35 U.S.C. §103 as being unpatentable over the '628 patent in view of Gibson et al. Applicants respectfully traverse this rejection and request reconsideration. It is believed that all of the originally filed claims are patentably distinct over the cited references.

As discussed above, the '628 patent does not disclose, suggest or motivate the present invention, particularly the requirement for rapidly cooling the melted mixture of solder and intermetallic phase components at a rate of at least 100 °C/sec to make the composite solder. The Gibson et al. reference teaches that 20 volume % intermetallic phase improves fatigue resistance of a solder. However, the Gibson et al. reference is not enabling because it does

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not teach or suggest a *method* for making such a solder. Therefore, neither the '628 patent, or the Gibson et al. reference, alone or in combination, teach or suggest a method for producing a composite solder comprising a step of rapidly cooling the non-solid composite solder mixture. The Examiner is improperly using hindsight reasoning in combination with this reference given the present invention as a template. Notwithstanding, this rejection is moot in light of the amendment to independent Claim 1. Applicants thus request withdrawal of the rejection.

The Examiner has also rejected Claims 10-13 under 35 U.S.C. §103 as being unpatentable over the '628 patent in view of U.S. Patent No. 5,520,752 (the '752 patent) to Lucey, Jr. et al. Applicants respectfully traverse this rejection and request reconsideration. It is believed that all of the originally filed claims are patentably distinct over the cited references.

Neither the '628 nor the '752 patents teach, suggest or motivate rapidly cooling a heated, non-solid mixture of a solder and the components of an intermetallic phase at a rate of at least 100 °C/sec to form a composite solder. Nor do they teach or suggest the advantages of using such a rapid cooling step so that one skilled in the art would be motivated to use such a step in producing a composite solder. The '752 patent discloses methods for forming the intermetallic particles by various methods. Col. 3, line 64 to col. 4, line 5. These intermetallic particles are then mixed with either paste or bulk solder to form a composite solder. Col. 4, lines 24-26. The mixture of solder and intermetallic particles are not heated to form a non-solid and then cooled to produce the composite solder. In contrast, the methods of the present invention do not preform the intermetallic phase, but mix together the

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components that make up the intermetallic phase with the solder, then heat the mixture to form a non-solid and rapidly cool the mixture to form the composite solder with the intermetallic phase. Hence, forming an *in-situ* composite solder. By way of non-limiting example, to produce the composite solder of the '752 patent,  $\text{Cu}_6\text{Sn}_5$  intermetallic particles are mixed with solder without heating. In the present invention, elemental Cu and elemental Sn are added to a solder in ratios that will give  $\text{Cu}_6\text{Sn}_5$  upon forming the composite solder.

The Examiner is improperly using hindsight reasoning in combination with this reference given the present invention as a template. Notwithstanding, this rejection is moot in light of the amendment to independent Claim 1. Applicants thus submit that neither the '628 nor the '752 patents, alone or in combination, teach or suggest the method of producing a composite solder of the present invention. Applicants therefore request withdrawal of the rejection.

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### CONCLUSION

It is respectfully submitted that the present amendment should be entered in accordance with the provisions of 37 C.F.R. §1.116 on the grounds that the claims as now presented are in better form for purposes of appeal, if necessary. No new issues have been raised, and moreover, the present amendment is believed to place the application in condition for allowance. Favorable consideration is respectfully requested.

Should an extension of time to respond be required, please consider this a request for such an extension and the Commissioner is authorized to charge any additional fees to Deposit Account No. 08-0750. A copy of the Transmittal Letter is submitted herewith for this reason.

Should the Examiner have any questions or wish to further discuss this matter, it is respectfully requested that the undersigned agent be contacted at (248) 641-1600.

Respectfully submitted,

Dated: 8/23/00

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Enclosures